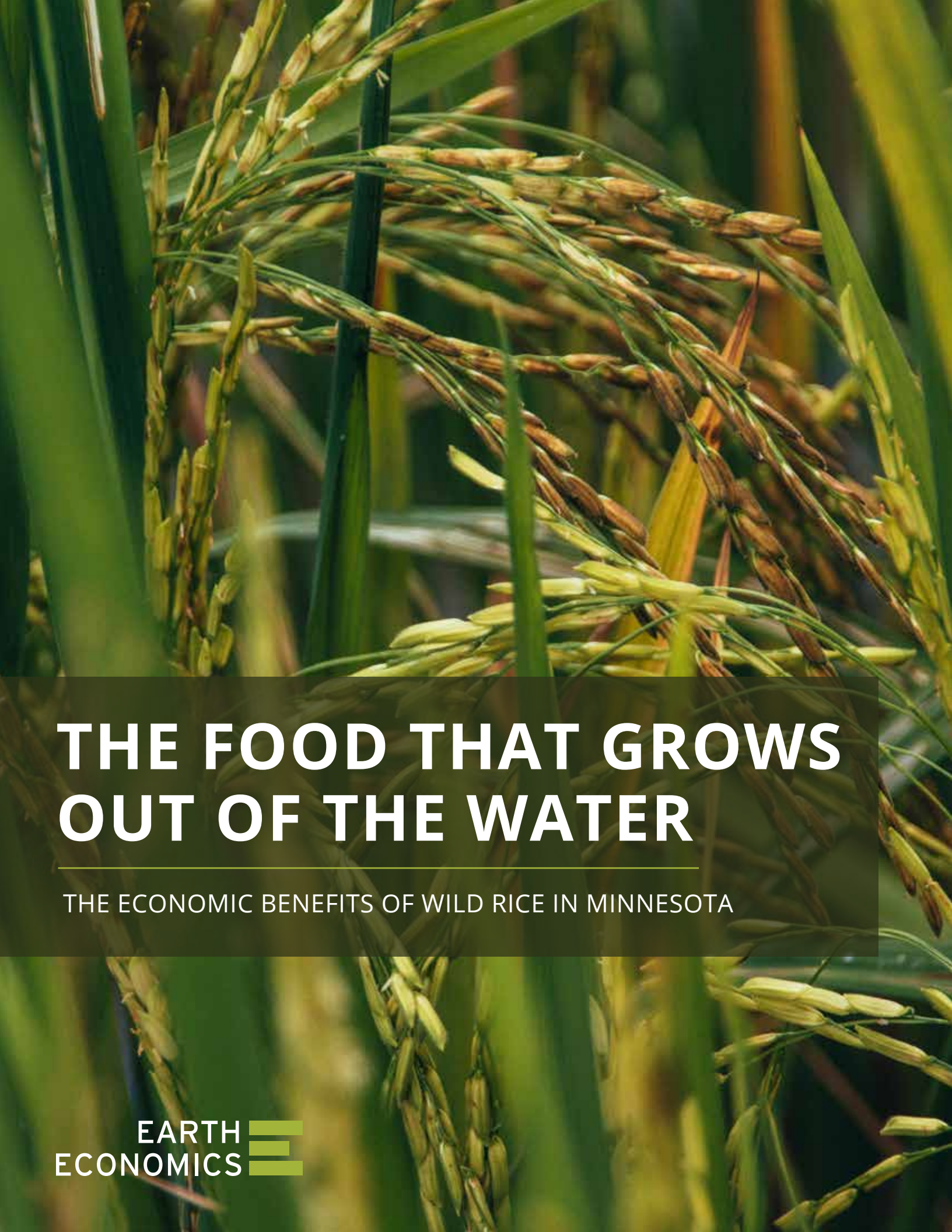

THE FOOD THAT GROWS OUT OF THE WATER

THE ECONOMIC BENEFITS OF WILD RICE IN MINNESOTA

EARTH ECONOMICS

WILD RICE SPROUTING
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The authors are responsible for the content of this report.

EXECUTIVE SUMMARY

NORTHERN HARRIER

WILD RICE, OR MANOOMIN, IS CENTRAL TO OJIBWE CULTURAL IDENTITY, SPIRITUAL TRADITIONS, AND PHYSICAL WELL-BEING. IT IS AN IMPORTANT SPECIES TO THE ECOLOGY OF MINNESOTA'S LAKES AND RIVERS AND PROVIDES CRITICAL FOOD AND HABITAT TO BOTH ENDEMIC AND MIGRATORY SPECIES.

Wild rice has been a significant contributor to Minnesota's economy for decades and continues to be one to this day. In 2011, Minnesota began a renewed effort to investigate the effects of aquatic sulfate pollution on wild rice with the possibility of modifying its current sulfate standard and adopting one that would permit greater levels of sulfate pollution in Minnesota waters. Research shows that higher levels of sulfate – which are converted to highly toxic sulfide by aquatic bacteria – threaten wild rice productivity. While the state has recently abandoned its exploration of a revised water quality rule for the time being, serious concerns remain as to what a potentially less protective rule would mean for manoomin, and what the impacts would be to the lives of Minnesotans who hand-harvest it as well as to Native Americans who depend on it for both economic and cultural viability.

In order to provide a more comprehensive understanding of the benefits wild rice provides for Minnesotans, this report aims to capture some of its economic value. While this report makes no attempt to assign monetary value to the cultural significance of manoomin – in unequivocal recognition that this value is far beyond economic measure – it does seek to make an economic case for protecting wild rice habitat. The cultural, health, ecological, and economic benefits of manoomin all depend on a healthy ecosystem that supports the plant's growth and development. So, by making an economic case for this, we aim to ensure that all the benefits of manoomin – including those that are not economic – will be available to future generations.

Wild rice has many ecological benefits too, like supporting waterfowl by providing a food source high in protein and carbohydrates. It plays a critical role in ensuring successful waterfowl migrations, and thus plays a critical role in waterfowl hunting in Minnesota. According to the 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, waterfowl hunters contributed more than 43 million dollars to the Minnesota economy, part of which is supported by wild rice habitat.[1]

Manoomin is also inextricably linked to food security for Native Americans in Minnesota. Native people consume approximately 3-10 pounds of hand-harvested manoomin every year. At a market-rate replacement cost of 11 dollars per pound, this adds up to 1.3 to 4.7 million dollars per year. We estimate that manoomin consumption among Native Americans also prevents an average of 90,000 dollars in food insecurity-related health care costs in the state. Depending on their consumption of manoomin, non-tribal consumers may also incur additional health savings.

Wild rice harvesters spend nearly 13 million dollars in Minnesota's economy each year, and these expenditures support about 153 local jobs. The more than 19 million dollars in annual income from the sale of wild rice supports an additional 125 jobs. Overall, wild rice supports nearly 278 jobs annually. However, these are only the jobs supported by the harvesting of wild rice. Wild rice-related jobs are also associated with other activities such as restoration projects. These additional sources were not able to be considered in this report. As such, the values in this report should be considered as underestimates of the contribution of economic benefits that wild rice provides to the Minnesota economy.

If wild rice resources decline, these economic benefits would diminish. For every 1 percent reduction in wild rice harvests, over 3,500 pounds of manoomin would have to be replaced in the Minnesota Ojibwe diet, a value of 39,000 dollars per year. Furthermore, each 1 percent decline in manoomin consumption incurs an additional 2,600 dollars in food insecurity-related health care costs. Finally, every 1 percent decrease in harvest results in a loss of 253,000 dollars in economic output and about 2 jobs in Minnesota.

Minnesota's wild rice is an asset worthy of investment and protection. The values presented in this report reveal the breadth and magnitude of the economic benefits that wild rice provides to Minnesota. Despite constraints due to data gaps in the analysis, the results we've estimated provide a broad sense of the economic importance of this asset. Still, the values in this report should be regarded as just a small portion of the true value of wild rice. Placing economic value on important cultural activities and resources can be controversial. Regardless of dollar value, subsistence rights should always be the primary consideration. While wild rice can be cultivated outside of its natural habitat, traditions and cultures are irreplaceable when lost. But, understanding the economic benefits of wild rice and economic contributions to communities can help to identify shared goals and sustainable management decisions.

INTRODUCTION

ANNETTE DREWES USES KNOCKING STICKS TO HARVEST WILD RICE IN A NORTHERN MINNESOTA LAKE NEAR BEMIDJI, MINNESOTA

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THERE IS NO ECONOMIC FRAMEWORK THAT CAN PROPERLY DEFINE THE VALUE OF MANOOMIN TO THE OJIBWE PEOPLE. FROM THE BEGINNING, COLONIZERS HAVE MISUNDERSTOOD THE TRIBE'S RELATIONSHIP WITH THIS CULTURAL RESOURCE BY VIEWING IT AS A MEANS OF PROFITING IN TRADITIONAL WESTERN MARKETS.

THE FOOD THAT GROWS OUT OF THE WATER

The third of seven prophets came to the Anishinaabe people more than one thousand years ago and told them to head west to their chosen land. When they found "the food that grows out of the water," they would know they were home, and this sacred food would feed their families' bodies and souls for generations to come. This journey is at the core of the Ojibwe migration story, and the sacred food at the center of their cultural identity, spiritual traditions, and physical well-being is manoomin, or wild rice. To the many bands of Ojibwe people who have made their homes for centuries around the lakes of Minnesota, manoomin is far more than a crop or a staple food. It is a sacred symbol that represents their journey, their relationship to the land that sustains them, and their very identity as Ojibwe people.

Minnesota tribes entered into treaties with the United States in the 1800's to reserve hunting, fishing, and gathering rights in the lands and waters ceded to the United States. The exercise of these rights is fundamental to tribes' cultures and ways of life and maintains religious, ceremonial, medicinal, subsistence, and economic needs.[2] Every federal agency has a responsibility to these tribes and their treaty rights, and this extends to the protection of the habitats that sustain manoomin.

The reservation of sovereign rights is part of any given tribe's ongoing struggle to preserve a culture that is best understood in terms of their relationship with the natural environment. Tribal members continue to harvest and rely upon manoomin for religious purposes including naming ceremonies, funerals, Midewiwin ceremonies, and various seasonal feasts. These activities are critical components in perpetuating Anishinaabe lifeways and cultural practices. Anishinaabe spiritual beliefs mandate the use of certain plants, animals, and fish in ceremonies attendant to hunting, fishing, and gathering activities. These ceremonies ensure the perpetuation of the resources and the physical, mental, and spiritual well-being of the person.

Tribal leaders have noted that elders in their communities reaffirmed the position that traditional foods, including manoomin, are medicine for Anishinaabe. Today, tribes experience higher than average rates of diseases such as diabetes and heart disease.[3,4] Much of the current state of Native American health can be traced back to historical practices that have displaced tribes and limited access to healthy and traditional foods, such as manoomin.[3,4]

Many tribes are dependent upon manoomin for subsistence needs. Many Native Americans eat manoomin at least once a month,[5] though historically this rate was much higher. Survey results show that manoomin is the most commonly consumed traditional food, and Native Americans wish to eat it more often.[5]

In assessing the importance of manoomin to tribal economies, it is important not to limit the benefit metrics to job and income measures. In regard to tribal manoomin harvests, sales of a portion of the harvest are often used to supplement subsistence (i.e. selling a portion of the manoomin harvest to cover costs for gasoline and other expenses enables tribal members to participate in subsistence activities and provide food for their extended families).

Because tribes were forced to participate in a western cash economy by European settlement, and manoomin has been appropriated as a commodity, it has since become a source of material wealth and economic survival for the Ojibwe, as well. However, the traditional role of manoomin is still clear today. The annual hand-harvest on Minnesota lakes and rivers is a cherished ritual that preserves time-honored traditions and builds tribal community. Harvesting rice by hand is part of a deeply held belief that this wild gift from the Creator, and the land that sustains it, should be treated with respect and gratitude rather than cultivated and exploited. Hand-harvested rice is frequently offered as gifts and is used as an offering in spiritual ceremonies and funerals.

There is no economic framework that can properly define the value of manoomin to the Ojibwe people. From the beginning, colonizers have misunderstood the tribe's relationship with this cultural resource by viewing it as a means of profiting in traditional western markets. While this report makes no attempt to assign monetary value to the cultural significance of manoomin – in unequivocal recognition that this value is far beyond economic measure – it does seek to make an economic case for protecting manoomin habitat. The cultural, health, ecological, and economic benefits of manoomin all depend on a healthy ecosystem that supports the plant's growth and development. So, by making an economic case for this, we aim to ensure that all the benefits of manoomin – including those that are not economic – will be available to future generations.

WILD RICE DURING FLOATING LEAF STAGE
CREDIT: KARI HEDIN, FOND DU LAC RESOURCE MANAGEMENT

WILD RICE AND **WATER QUALITY**

The current water quality standard of 10 mg/L of sulfate for Minnesota lakes is based on research dating back to the 1940s that showed that sulfate has a negative effect on wild rice and that the grain was not found in areas with high concentrations of sulfate in the water.[6] Observational data showed that wild rice was uncommon and even absent in waters with sulfate levels between 10 and 50 mg/L. In 2011, Minnesota began a renewed effort to investigate the effects of sulfate on wild rice. The new research showed that sulfate is harmful to wild rice, because common bacteria converts sulfate to sulfide in the wetland soil where the rice grows.[7] Sulfide is toxic to wild rice; it adheres to the roots and inhibits nutrient uptake, thus starving and ultimately killing the plant.

Elevated levels of sulfide have been shown to be detrimental to the growth of wild rice, reducing seedling survival, productivity, weight, and viability.[7] Additional research provides further evidence of this threat to wild rice by demonstrating that high concentrations of aquatic sulfide decreases the probability of the presence of wild rice in otherwise favorable habitats.[8] By studying the effects of water quality on wild rice, researchers found that increases in sulfate loading to surface waters can have multiple negative consequences for ecosystems, and that wild rice is therefore an important indicator of water quality.[4] This research is currently being used to inform the state's water quality standards. While the evaluation of the sulfate standard is ongoing, research continues to show that additional sulfate and the corresponding increase in sulfide are extremely harmful to wild rice survival and productivity.

GRAND PORTAGE BAND MEMBERS AFTER A GOOD DAY'S HARVEST

CREDIT: CHARLIE BLACKWELL

PURPOSE OF **THIS REPORT**

In response to the positive relationship researchers identified between wild rice and water bodies with lower sulfate levels, a statewide sulfate standard was adopted in 1973 to protect wild rice. In 2011, the State of Minnesota began investigating what a revised standard, or water quality rule, on the protection of wild rice might look like. While the state has recently abandoned its exploration of a revised water quality rule for the time being, serious concerns remain as to what a potentially less protective rule would mean for manoomin, and what the impacts would be to the lives of Minnesotans who hand-harvest it as well as to Native Americans who depend on it for both economic and cultural viability. This report aims to show that wild rice provides economic benefits to Minnesota and to identify the impacts that a change in the water quality rule would have on these benefits. However, attaching a dollar value to harvests that are culturally important is difficult for many reasons. Naturally grown wild rice and hand-harvesting traditions are priceless. An additional difficulty is that, by nature of the tradition itself, most hand-harvested wild rice does not enter traditional markets. There are few records of economic transactions relating to the hand-harvesting of wild rice, because it is not primarily an economic practice.

The numbers we provide in the report are intended to increase awareness about the importance of wild rice to the Minnesota economy. Due to limited scope, there are many other values this report does not consider. These values don't include those that people place on participating in hand-harvesting of manoomin, or the importance of manoomin in Ojibwe tradition and history, or the many other important cultural values manoomin holds. The dollar values in this report should be regarded as comprising one type of value and as a very small portion of the true value of manoomin. Placing economic value on important cultural activities and resources can be controversial. Regardless of dollar value, subsistence rights should always be the primary consideration. While wild rice can be cultivated outside of its natural habitat, traditions and cultures are irreplaceable when lost.

AMERICAN BITTERN

ECOLOGY OF WILD RICE

Wild rice (genus Zizania) is an annual grass that grows in shallow water and slow-flowing streams and produces an edible grain.[9] It is native to Minnesota and can be found in 55 counties in the northern region of the state, though its range once covered the entire state. Current coverage of wild rice has declined to at least 64,000 acres when growing conditions are favorable.[9]

A fast-growing, aquatic grass, it sustains both migratory and local wildlife, providing critical food and shelter at every stage of its growth and throughout all four seasons.[9] Migrating and resident species alike rely on the plant's nutritious and abundant seeds. In the fall, many species of duck rely on wild rice as a staple food source. Plant stems provide brood cover for waterfowl and nesting material for species such as common loons, red-necked grebes, and muskrats. Insect larvae that feed on wild rice serve as a rich food source for blackbirds, bobolinks, rails, and wrens. In the spring, decaying rice straw supports a diverse community of invertebrates that in turn supports birds, fish, and amphibians. In the summer, the whole plant provides food for herbivores like Canada geese, trumpeter swans, muskrats, beavers, white-tailed deer, and moose. Due to the plant's diverse ecological value, wild rice lakes and streams serve as breeding and nesting areas for at least 17 species listed as "species of greatest conservation need" on MNDNR's Comprehensive Wildlife Conservation Strategy.[9] As an aquatic plant, it also provides habitat for fish.[10]

Wild rice provides additional ecological values by improving the quality of ecosystems, allowing for increased ecosystem function. By sequestering nutrients such as phosphorous and nitrogen, wild rice enriches soils while countering the negative effects of nutrient loading in water bodies that can cause algal growth and turbidity. Stands of wild rice form windbreaks and slow water velocity, limiting the mixing of soil nutrients into the water column. They also prevent erosion by stabilize loose soils.[9]

ECONOMIC IMPORTANCE OF WILD RICE

Historically, wild rice was the most important grain in Minnesota's economy. Because it was a dietary staple, easily stored for long periods of time, and easy to use, it held considerable economic value for native people and early explorers and settlers. Although other grains became common over time as they were introduced to Minnesota by immigrants, wild rice continued to be popular. Records of state license sales going back to the 1950s clearly show the enduring popularity and value of wild rice. More than 300,000 licenses have been sold since 1957. Prior to 1970, Minnesota provided half of the global market supply of wild rice; most of which was from hand-harvested natural stands.[9] As cultivation of wild rice increased, by 1990, natural hand-harvested wild rice in Minnesota accounted for less than 10 percent of the global supply of wild rice. Yet, hand-harvested wild rice remains a vital part of the state's tribal and local economies. In fact, the largest part of the economy revolving around wild rice is the "underground" economy. Much of people's manoomin harvest is gifted or traded and is never tracked in any organized fashion. There is very little accounting or tracking related to wild rice sales, spending, or harvest. Yet, aside from the cultural importance of the activities, this barter and trade system is also important to the economic wellbeing of harvesters by reducing food costs and improving food security.

The effects of wild rice harvesting ripple throughout the economy in obvious and less obvious ways. Some harvesters sell a portion of the wild rice they gather for obvious economic gain. But additional contributions stem from the costs to undertake harvesting, such as gas, drying tarps, or canoes. Those expenditures support other sectors in the Minnesota economy, like retail and service. Wild rice also supports the Minnesota economy in other, less obvious ways. Conservation agencies, tribes, and other groups and organizations invest enormous amounts of money in ecosystem restoration projects that rely on native wild rice as an important plant. And, due to their magnetism for waterfowl, wild rice waters serve as popular hunting grounds. According to the 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, waterfowl hunters contributed more than 43 million dollars to the Minnesota economy.[1] Although hunting numbers on wild rice waters are currently unknown, Ducks Unlimited suggests that no other habitat sees such high concentrations of waterfowl.[11] The shared value that so many Minnesotans place on wild rice habitat is reflected by the widespread efforts of hunting clubs, private citizens, and conservation groups to seed and expand it.

METHODOLOGY

ANNETTE DREWES STUFFS A BAG WITH NEWLY HARVESTED WILD RICE ON A NORTHERN MINNESOTA LAKE NEAR BEMIDJI, MINNESOTA.
© RICHARD HAMILTON SMITH

AS A FOUNDATIONAL ELEMENT OF OJIBWE CULTURE AND IDENTITY, MANOOMIN, OR WILD RICE, IS PRICELESS. BUT BY MAKING THE ECONOMIC CASE FOR THE PROTECTION OF WILD RICE HABITAT, WE CAN ENSURE THAT THE MANY ECONOMIC AND NON-ECONOMIC BENEFITS OF THIS IMPORTANT PLANT CAN BE ENJOYED FOR GENERATIONS TO COME.

ANALYSIS OF **FOOD SECURITY**

Food security is a state wherein people have access to sufficient, safe, nutritious, and culturally appropriate food. That access includes both the physical availability or proximity to these foods as well as the economic means to acquire them. Food insecurity is thus defined as limited or uncertain access to this food. Food is fundamental to human existence, and food insecurity can result in developmental issues for children and negative health outcomes for all members of a household.

This analysis focuses on food insecurity for tribal consumers only. It does not account for the effects and resulting costs to non-tribal consumers due to limited wild rice consumption data for this population. The United States Department of Agriculture (USDA) and other national organizations, such as Feeding America, track relevant statistics related to food insecurity. These sources, along with additional white papers and peer-reviewed articles, provided the information on national food insecurity rates, the disproportionate levels experienced by Native communities, and the resulting health outcomes that Native Americans face on a national level. However, region-specific information on Native American food insecurity in the United States is limited. Therefore, the national average rate of food insecurity among Native Americans was applied to Minnesota for this study.

Food insecurity is a complex problem resulting from the interplay of various factors that affect access to and the ability to afford food. Fundamentally, it is a measurement that assesses whether or not households have sufficient levels of food. Therefore, it does not account for specific food items, such as wild rice. Nonetheless, the relationship between traditional foods and Native American food security, the robust health benefits of manoomin, and the limited food access faced by populations in this area underscore the importance of this resource in fighting food insecurity among Native Americans. However, without specific data on overall dietary intake and pre- and post- assessments, it is difficult to assess the exact change in food insecurity levels that would result from a less protective water quality rule. Therefore, this analysis monetizes the food security benefits of manoomin by focusing on the replacement costs of gathered manoomin and the health care costs related to food insecurity.

To estimate replacement costs, a baseline quantity of the amount of manoomin consumed by Native Americans in Minnesota each year is needed. In the absence of this information, we calculated an estimate based on historical survey data on the number of Native American consumers and the frequency of manoomin consumption.[5] This survey data was extrapolated to state-level population numbers obtained from the US Census. We assumed that one occurrence of manoomin consumption corresponds with consumption of one serving size on the low end and two servings on the high end. We estimated total pounds consumed based on a serving size of one half cup of uncooked rice.

Price data for replacement costs of manoomin came from survey data and online searches of current sale prices and was supported by qualitative information. The price per pound was applied to the total number of pounds consumed, minus the percentage of survey respondents that already bought their rice from a store,[5] to estimate the store-bought replacement cost of hand-gathered manoomin. To estimate avoided health care costs, we calculated the percentage of an average Native American diet that is composed of manoomin based on the total pounds consumed. This percentage was applied to data on the health care costs of food insecurity to estimate the avoided health care costs that can be attributed to manoomin. This food insecurity analysis also looks at Native Americans solely as consumers of manoomin and does not take into account income earned from the potential sale of gathered manoomin, which is analyzed in the next section.

ANALYSIS OF ECONOMIC CONTRIBUTIONS

Economies are diverse systems of relationships and dependencies. An uptick or downturn in one sector has a variety of impacts across others. When an employer goes out of business, it isn't just the newly unemployed who feel the economic pain, and the same is true when a valuable resource like wild rice disappears. It's critical to consider these interrelated economic impacts when making decisions or developing policy, and the gold standard for doing so is input-output analysis. It allows developers, planners, investors, and government officials to make development, investment, and policy decisions based on anticipated benefits to the economy as a whole, rather than focusing on isolated impacts or the specific effects to an individual sector. Inputs in one sector can have various effects on the outputs of another, and vice versa. As money is spent on the materials and labor required to complete a single project or activity, the effects of each dollar spent ripple across sectors throughout the region. Increased spending on wages in one sector can lead to increased sales in another, which in turn leads to additional hiring in yet another. This systems-oriented approach to economic analysis leads to a more holistic understanding of the consequences of particular policy actions and allows for more efficient allocation of resources.

In an input-output analysis, the total impact of an action is the sum of the *direct*, *induced*, and *indirect* effects it produces. The expenditures and economic activity around wild rice can be grouped into these three categories. The economic activity that results from the initial expenditures associated with gathering wild rice are considered *direct* effects. This includes spending on gas required to travel to wild rice lakes and the purchase of clothing and gear needed for the harvest. These *direct* expenditures then generate secondary effects. Employees of the establishments that sell the gas, clothing, and gear spend their wages on things like rent and groceries, spurring *induced* effects across the community. Finally, there are the *indirect* effects. Not only do businesses pay wages that get spent throughout local communities, but they make purchases of their own as part of the costs of doing business. These business-to-business purchases on goods and other operating expenses are the *indirect* effects of those direct wild rice-related expenditures. Economic activity ripples out from each transaction, leading to other transactions, over and over.

Wild rice has long been an economic engine for communities across Minnesota in several key ways. First, it is an essential component of the Native American culture and economy in Minnesota. In addition to harvesting manoomin for subsistence and for gift, many Native Americans support their way of life through selling the manoomin they harvest in Minnesota's shallow pools and slow-moving rivers. Second, tribal ricers and non-tribal ricers generally incur some level of spending to purchase the supplies needed to harvest manoomin. So, even if they are not selling their rice, they are still investing dollars in the local economy in order to harvest it. Finally, the state generates revenues from wild rice license sales that support wild rice management.

Our calculation of total estimated spending by wild rice harvesters in Minnesota includes data from a brief survey implemented jointly by Earth Economics and the Fond du Lac Band of Lake Superior Chippewa.[12] We collected data on expenditures; amount of rice harvested; proportion of harvest gifted, kept, or sold; and average sale price of wild rice harvests from 19 tribal and non-tribal ricers throughout the state. Survey data was then aggregated, and below-average, average, and above-average spending profiles were developed for both harvesting groups. See Appendix B for statistics on the questionnaire results.

To measure these broader economic contributions of wild rice, we used a software program called IMPLAN® V3.0 (IMpacts for PLANing). IMPLAN® was originally developed by the United States Forest Service in order to analyze the impacts of the timber industry. It was later sold to Minnesota

IMPLAN Group and is now the primary tool used by both the private and public sectors in order to conduct input-output analyses. IMPLAN is a static, linear, input-output model, based on empirical economic data that is periodically updated. This means that the models within IMPLAN reflect the economy at a given time and do not account for price elasticities or changes in consumer behavior. Input-output models make assumptions about linkages within an economy, and the secondary effects do not perfectly reflect consumer behaviors. Moreover, final IMPLAN estimates are partly based on inputs (e.g., expenditure data) provided by the analyst. The input data required for the program to complete the analysis consists of the dollar amounts described above. Expenditures on gas, restaurants, processing, and equipment directly support local jobs, income, and public revenues (direct effects). The IMPLAN model also generates secondary effects, as employees of the above establishments spend their income on things like rent and food (induced effects), and business-to-business purchases (indirect effects). Each dollar figure is assigned a sector from a national database, and the software matrix determines the total impact based on the assigned sectors as they relate to the Minnesota economy. By using these standardized datasets and methods, we modeled the jobs , labor income, economic contribution, and contributions to GDP for Minnesota wild rice.

RIPE WILD RICE ON A RESERVATION LAKE

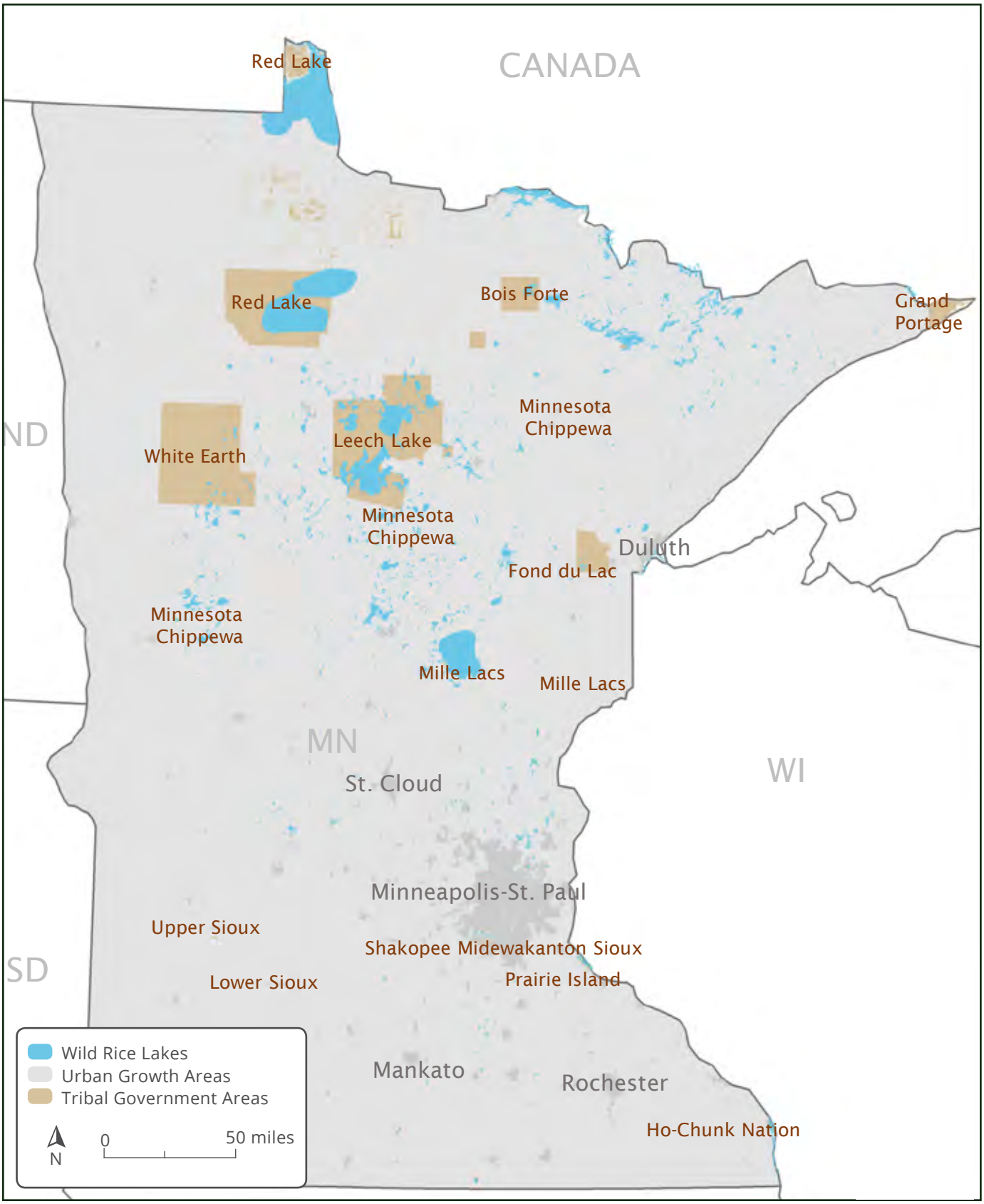
CREDIT: TOM HOWES, FOND DU LAC RESOURCE MANAGEMENT

ANALYSIS OF THE IMPACTS OF **CHANGING WILD RICE ABUNDANCE**

Research shows that wild rice is extremely sensitive to sulfide. Yet, there is no consensus on acceptable levels of sulfate - the aquatic precursor to toxic sulfide - in regards to protection of wild rice. As Minnesota looks to revise its water quality standard for sulfate, it is unclear how adjusting the 10 mg/L sulfate standard for wild rice protection would influence the abundance of wild rice over time. As there is no scientific consensus on how sulfate specifically influences wild rice abundance, we conducted a robust scenario analysis using models informed by the data described in the previous sections to illustrate various impacts based on a 1 percent change in wild rice abundance in Minnesota. A scenario analysis allows us to better understand how the proposed rule change will affect two things: 1.) the already serious levels of food insecurity among Minnesota tribes, and 2.) the economic contributions of wild rice harvesting to the state. Scenario analysis is a method of estimating possible future outcomes under different circumstances. It's a valuable tool for decision making and for better understanding the complex effects of given policy or action alternatives. A rule that decreases water quality will degrade wild rice habitat and thus decrease productivity. This will result in more people who depend on manoomin becoming food insecure, and a decrease in the economic benefits associated with harvesting. By clearly enumerating these impacts, this analysis underscores the importance of wild rice as a source of high-quality, easily accessible food for the people that harvest it and as an economic driver for Minnesota.

TRIBAL HARVESTING OF WILD RICE ON DEADFISH LAKE
CREDIT: FOND DU LAC RESOURCE MANAGEMENT DIVISION

WILD RICE LAKES OF MINNESOTA



CURRENT BENEFITS OF WILD RICE

WILD RICE IN KATHIO STATE PARK, MINNESOTA
CREDIT: BRETT WHALEY VIA FLICKR

IN ADDITION TO THE MANY SOCIAL, CULTURAL, AND ENVIRONMENTAL BENEFITS PROVIDED BY WILD RICE, THERE ARE ECONOMIC ACTIVITIES ASSOCIATED WITH THIS RESOURCE, AND THOSE ARE ENORMOUSLY VALUABLE TO OUR COMMUNITIES.

FOOD SECURITY-RELATED BENEFITS OF WILD RICE

Manoomin was part of a subsistence diet for indigenous peoples that began declining with colonization. The establishment of reservations limited access to traditional staples, and Native Americans experienced nutritional deficiencies and food insecurity that continues today.[3] Currently, Native Americans suffer from above-average rates of food insecurity. In the US, 25 percent of American Indians/Alaskan Natives (AI/AN) are food insecure, compared to the national average of 12.3 percent, and they are twice as likely as whites to suffer from food insecurity.[13,14] Poverty, limited access, and higher prices all contribute to the high levels of food insecurity among Native Americans. Low incomes limit an individual's ability to afford and purchase sufficient food. AI/AN have the highest rate of poverty of any racial group. With an estimated 28 percent of AI/AN people living below the poverty line, they face a poverty rate that is double the national average.[15]

Higher meal prices also make it more difficult for Native Americans to maintain food security. The average meal price for counties with a majority of American Indians is 3.[18] dollars, compared to the national average of 2.82 dollars.[13] Additionally, access to healthy food is difficult and limited in rural areas. Much of northern Minnesota, including parts of Carlton and St. Louis counties where the Fond du Lac Reservation is located, suffers from limited food access, according to the USDA. This means that a significant number of residents are more than 10 miles from the nearest supermarket in these low-income, rural census tracts.[16] The disproportionately high levels of food insecurity and poverty among Native Americans as well as the high food prices and limited food access they face in Minnesota all make traditional foods like manoomin a vital part of the Native American diet and an important resource in fighting food insecurity.

Food insecurity results in documented negative health impacts for populations and increases the risk of chronic diseases such as obesity, diabetes, and heart disease.[14] Native Americans experience double the rate of heart disease compared to other populations,[3] the highest rate of Type II diabetes in the country, and are twice as likely to die from diabetes.[17] AI/AN also have the highest blood pressure and cholesterol levels of any racial group[3] and are more likely to suffer from obesity.18 Additionally, the threat of these diseases is rapidly increasing—Native Americans have developed higher than normal rates of obesity in less than a generation,[19] and the incidence of diabetes is rising faster among Native American children than any other ethnic population.[20] Overall, Native Americans endure a significantly lower health status and disproportionate rates of disease compared with all other Americans.[20] Much of the current state of Native American health can be traced back to historical practices that have displaced tribes and limited access to healthy and traditional foods. As a result, consumption of Native foods has decreased, and tribes increasingly rely on unhealthy, store-bought food.[3,4]

In addition to producing negative health effects, food insecurity is also a strong predictor of health care costs and use.[21] This has significant economic impacts, because people who suffer from food insecurity have been shown to accrue an average of 1,863 dollars more in health care expenses per year compared to food secure individuals.[22] Food insecurity-related health care costs for Native

Americans in Minnesota are thus estimated to total 28.4 million dollars in the state. While these costs are significant, they are likely an underestimate of the cost of food security for Native Americans in Minnesota, because they do not take into account the higher rates of diet-related diseases among Native Americans.

Traditional foods like manoomin help to reduce food insecurity and can also ease diet-related health issues. Research has shown for various native groups that consumption of traditional food has resulted in health benefits such as reduced obesity, diabetes, and cardiovascular risk as well as improved nutritional profiles.[19] For many tribes, the portion of their diet containing traditional food had a greater nutrient density than the portion composed of store-bought food. Conversely, Native American adult diets with a majority of energy from store-bought food were shown to be nutritionally inadequate.[19] Efforts to improve indigenous peoples' diets and lifestyles have been the most successful when traditional practices and foods are used, further underlying the importance of native food for health.[9] Studies show that limited access to traditional food is a major cause of food insecurity, and that increased access to traditional food is associated with higher food security.[19,20] Reduced access to manoomin will therefore increase Native American food insecurity and health care costs.

Historically, manoomin was a staple in traditional Native American diets and consumed at a much higher rate given its availability and accessibility. Survey results from 2018 showed that Native American respondents wished to almost double their consumption of manoomin.[12] Another study showed that even though manoomin was the most commonly consumed traditional food, Native Americans wished to eat it even more often and cited it most often for its health benefits.[5] Most Native American respondents consumed manoomin that was gifted (50 percent) or harvested (37 percent), while 29 percent bought it from the store. The small number of people purchasing manoomin from a store could be because of cost—hand-harvested manoomin often sells for 11 dollars per pound compared to white rice which sells for an average of 0.68 dollars per pound. Nonetheless, nearly 58,000 Native Americans in Minnesota consume between about 155,000 and 563,000 pounds of hand-harvested manoomin a year, with the lower estimate assuming people eat 90 grams each time they eat manoomin (one service of ½ cup of uncooked manoomin) and the upper estimate assuming people eat 180 grams of rice each time they consume manoomin.

Manoomin is an important part of Native Americans' diet, health, and food security, and its economic benefit can be measured through replacement costs and health care-related costs. To estimate replacement costs, we took the total pounds of manoomin consumed per year and excluded the percentage that respondents stated they bought from a store. At this level of consumption, Native American consumers save between 1.3 and 4.7 million dollars per year—the cost of replacing the hand-harvested manoomin with store-bought manoomin at 11 dollars per pound. At an average of 3 million dollars per year, this is approximately 52 dollars per person for Native American consumers in Minnesota. If Native Americans were to replace their consumption of hand-harvested manoomin with the purchase of cultivated manoomin, which typically sells for about 7.80 dollars per pound, it would

Table 1. *Pounds of Manoomin Consumed in Minnesota by Native Americans*

RICE SOURCE	POUNDS CONSUMED		
	LOW	AVERAGE	HIGH
HAND-HARVESTED	117,028	271,673	426,317
STORE-BOUGHT	37,558	87,188	136,818
TOTAL	154,586	358,861	563,135

Source: Fond du Lac Community Bio-monitoring Survey[5]

cost between about 1 to 3 million dollars per year. While white rice would be a cheaper alternative, it is not an adequate replacement, because it lacks the nutritional value and health benefits of manoomin and is not linked to food insecurity reduction like manoomin is.

Given the many health benefits of manoomin, it is probable that its consumption translates to reduced healthcare costs. While it is difficult to ascertain the exact amount of health care costs that are prevented by manoomin consumption, its association with food security among Native Americans means that manoomin helps to prevent additional food insecurity-related health care costs. Though the health care costs of food insecurity are complex and cannot be linked to one particular food, we conduct this analysis under the assumption that these health care costs are reduced by the proportion of an average diet composed of manoomin. The true effects of manoomin on reduced healthcare costs could be larger or smaller than this assumption. Based on the calculated pounds of manoomin eaten per person per year, manoomin makes up less than one percent of an average Native American's diet in Minnesota (between 0.13 percent and 0.5 percent). Therefore, this traditional food may prevent a corresponding percentage of additional food insecurity-related health care costs of between about 38,000 and 142,000 dollars per year. On average, this is 90,000 dollars per year of prevented health care costs for Native Americans in Minnesota, or 5.90 dollars per food insecure person.

WILD RICE HARVEST SCENE OF THE KNOCKING STICKS IN A PILE OF WILD RICE IN BOTTOM OF CANOE.

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ESTIMATING THE NUMBER OF **WILD RICE HARVESTERS**

To estimate the number of tribal ricers, we used data obtained from personal communication with tribal members and from surveys conducted by the 1854 Treaty Authority.[23,24] These surveys had a total sample size of 715 people, which was used to calculate the weighted average of percent of respondents who harvest wild rice. This weighted average is 36 percent of respondents. In absence of additional information, we assume this rate also applies to all tribal communities except for the Dakota communities in the south of Minnesota. We exclude the Dakota communities from this analysis under the assumption that they do not harvest wild rice at comparable levels. According to Census data, the population on the 7 Ojibwe reservations in Minnesota is 37,043.[25] If 36 percent of this population harvests wild rice, the estimated number of Native American harvesters in the state is 13,367. Estimation of non-tribal harvesters was more straightforward. We used the ten-year average of Minnesota wild rice harvesting licenses as an estimate of the average annual amount of non-tribal harvesters, which is about 1,820 licensed harvesters annually.[26]

MARCUS AMMESMAKI POLING THROUGH WILD RICE BED WITH MIKE SAVAGE
CREDIT: CHERYL KATZ

WILD RICE HARVESTER EXPENDITURES

To understand how the harvesting of wild rice contributes to Minnesota's economy, we must study the spending habits and other costs directly associated with this activity. Tribal and non-tribal ricers are associated with different spending profiles. One difference in spending profiles is that non-tribal ricers are required to purchase a state license, while tribal harvesters are not required to have a state license. Table 2 shows the estimated spending by harvesters across different industries, excluding license sales, which were assessed separately. These were estimated from the harvester questionnaire (full results in Appendix B).

Non-tribal ricers tended to spend about 234 dollars per person, per year on expenditures related to wild rice harvesting. Tribal ricers spent about 901 dollars per person, per year. In both harvester groups, the main source of expenditures was gas to travel to and from wild rice lakes. Total expenditures by both harvester groups amount to nearly 12.5 million dollars annually.

Non-tribal ricers also must purchase a license in order to harvest wild rice from lakes. Though the associated revenue is small in comparison to the spending associated with harvesting, wild rice harvest licenses support key management activities, including managing water levels on wild rice lakes, improving or maintaining outlets, and assessing habitat. Though only a portion of license sales cover the expense of this program, we have estimated the effects of the revenue stream here. The ten-year average of revenue generated by license sales is more than 43,000 dollars per year.[26]

Table 2. *Annual Per-Person Expenditures by Harvest Type and Industry*

EXPENDITURE CATEGORY	IMPLAN SECTOR	AVERAGE SPENDING PER PERSON PER YEAR
TRIBAL HARVESTERS		
Clothing/misc.	Retail - clothing, clothing accessories	$39
Distribution	Wholesale trade	$197
Equipment	Building material, garden equipment	$75
Gas and Oil	Refined petroleum products	$257
Processing	Support activities for agriculture, forestry	$332
TOTAL		**$901**
NON-TRIBAL HARVESTERS		
Clothing/misc.	Retail - clothing, clothing accessories	$21
Distribution	Wholesale trade	$2
Equipment	Building material, garden equipment	$15
Gas and Oil	Refined petroleum products	$64
Misc. Retail	Miscellaneous store retailers	$87
Processing	Support activities for agriculture, forestry	$45
TOTAL		**$234**

HARVEST AND SALES OF **WILD RICE**

Tribal and non-tribal ricers tend to collect different amounts of wild rice. Estimates of wild rice harvest vary. Table 3 shows annual harvest estimates from the literature and survey conducted as part of this work. We found that across both harvester types, an average of 431 pounds of wild rice was harvested per person, which is similar to other estimates found in the literature. State harvesters tended to harvest less than tribal ricers, averaging 107 pounds per person. Tribal ricers averaged 723 pounds per person per year.

Some harvesters sell a portion of the wild rice they gather. We gathered statistics on wild rice sales from several surveys conducted in Minnesota.[12,27,28] A total of approximately 71 percent of harvesters (tribal and non-tribal) sell a portion of their harvest, be it processed (finished) or unprocessed (green).[27] Survey results found that tribal ricers tended to sell about 41 percent of their harvest.[12] Some of this harvest may be sold as unprocessed (green) rice, or processed rice. A survey conducted by Minnesota Department of Natural Resources (DNR) found that about 15 percent of ricers sold a portion of their harvest as green rice.[28] The average proportion of unprocessed wild rice sold out of total harvest was about 27 percent per harvester. Unprocessed wild rice sells for 2 to 4 dollars per pound, and for this analysis, we used a price of 3 dollars per pound. We assume the remainder of the proportion of harvest sold, 14 percent, was sold as processed wild rice. Ricers charged about 10 to 12 dollars per pound for their harvest, or on average 11 dollars per pound.[12] Next, we assumed 56 percent of ricers only sell processed rice, and 41 percent of their harvest is sold as processed rice at 11 dollars per pound. Using these estimates, we found that tribal ricers in Minnesota earn approximately 27.8 million dollars from selling green and processed wild rice each year, or about 2,900 dollars per person annually. After deducting expenses of 8.5 million dollars, or 901 dollars per harvester, proprietor income totals just over 19 million dollars, or 2,000 dollars per harvester.

Non-tribal harvester sales were more difficult to estimate, because much less data is available. We assumed that 71 percent of non-tribal ricers sold a portion of their harvest, as the DNR survey addressed both tribal and non-tribal harvesters. We assumed that non-tribal harvesters sold only processed rice, due to lack of data and conflicting estimates in the literature. The DNR survey found that approximately 84 percent of processed harvest was kept for personal use, while 16 percent of processed harvest was not kept by the harvester.[28] We assume this 16 percent is sold, in absence of other information. Non-tribal ricers may earn approximately 243,000 dollars in income from selling a portion of their harvest, or almost 200 dollars per person annually. However, their expenses averaged 233 dollars per person, and therefore no proprietor income was realized.

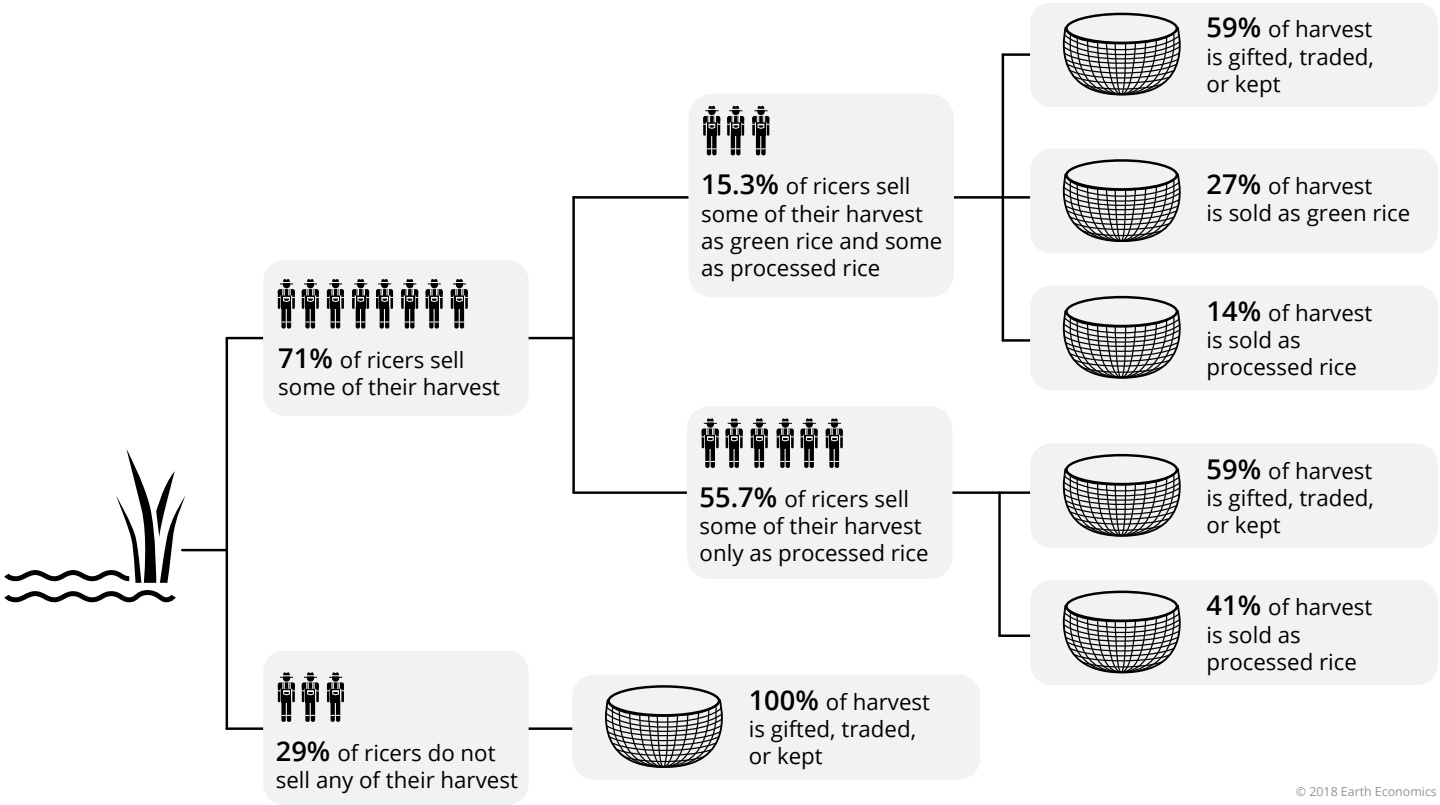
Table 3. *Wild Rice Harvest Estimates by Source*

SOURCE	HARVESTER TYPE	HARVEST ESTIMATE (AVG. LBS PER PERSON)
Drewes (2008)[27]	Non-Tribal and Tribal	512
Norrgard et al. (2007)[28]	Non-Tribal and Tribal	430
Fond du Lac and Earth Economics (2018)[12]	Non-Tribal and Tribal	431
Fond du Lac and Earth Economics (2018)[12]	Non-Tribal	107
Fond du Lac and Earth Economics (2018)[12]	Tribal	723

Table 4. Calculations and Results of Estimating the Sale

METRIC ESTIMATED	ESTIMATES
Total Tribal Harvesters	13,367
Tribal Harvester Who Sell	9,491
Pounds Sold - Green	399,234
Pounds Sold - Processed	2,414,056
Sale Price/lb - Green	$3
Sale Price/lb - Processed	$11
Revenue - Green	$1,197,702
Revenue - Processed	$26,554,613
Total Revenue	$27,752,315
Total Expenses	$8,551,003
PROPRIETOR'S INCOME	**$19,201,311**

Graphic 1. Estimated Pathway from Source to End Use of Wild Rice Harvest



CONTRIBUTION OF WILD RICE TO MINNESOTA'S ECONOMY

Spending by harvesters contributes significantly to Minnesota's economy. Spending on clothing, equipment, food, and processing stimulates the local economy, and the effects ripple out from there. Using the estimates above, nearly 12.5 million dollars are spent annually by tribal and non-tribal harvesters, with the majority of this spending, 12 million dollars, supported by tribal harvesters. Spending by both groups results in an estimated 153 jobs per year, in sectors such as support activities for agriculture and forestry (processing), wholesale trade, and retail. Spending effects are shown in Table 5 and Table 6.

It is estimated that 71 percent of harvesters sell a portion of their wild rice harvest; either as green, unprocessed rice, or as finished, processed rice. The income that is generated from the sale of wild rice further stimulates local economies throughout Minnesota. This analysis estimates the economic activity that results from the sale of wild rice by tribal members. These effects are shown in Table 7. Though it is known if non-tribal harvesters also sell wild rice, these effects are not estimated here.

Finally, the effects associated with the license sales are estimated in Table 8.

Given the spending, income generated from sales of wild rice, and license revenue, wild rice directly supports about 117 jobs each year. Secondary effects (indirect and induced effects) are estimated to support 161 additional jobs within the economy, for a total of about 278 jobs supported. These results are presented in Table 9.

Another way to view these results is by comparing jobs supported per million dollars in investment. Our analysis shows that for each 1 million dollars in spending associated with wild rice, about a dozen jobs are supported. This is comparable to other industries in Minnesota, such as the auto manufacturing industry (fewer than 3 jobs per million dollars invested), or the construction industry (13 jobs per million dollars invested).

***Table 5**. Non-Tribal Spending Effects*

IMPACT TYPE	EMPLOYMENT	LABOR INCOME	VALUE ADDED	OUTPUT
Direct Effect	4.2	$110,497	$143,316	$262,722
Indirect Effect	0.4	$22,812	$36,459	$66,036
Induced Effect	0.9	$42,152	$70,588	$123,337
Total Effect	**5.4**	**$175,461**	**$250,364**	**$452,096**

***Table 6**. Tribal Spending Effects*

IMPACT TYPE	EMPLOYMENT	LABOR INCOME	VALUE ADDED	OUTPUT
Direct Effect	112.6	$3,582,963	$4,474,107	$7,804,546
Indirect Effect	7.8	$497,539	$751,269	$1,403,279
Induced Effect	26.7	$1,289,117	$2,159,140	$3,772,199
Total Effect	**147.1**	**$5,369,619**	**$7,384,515**	**$12,980,025**

Table 7. Proprietor Income Effects

IMPACT TYPE	EMPLOYMENT	LABOR INCOME	VALUE ADDED	OUTPUT
Direct Effect	0	$0	$0	$0
Indirect Effect	0	$0	$0	$0
Induced Effect	124.6	$5,974,687	$10,035,800	$17,500,478
Total Effect	**124.6**	**$5,974,687**	**$10,035,800**	**$17,500,478**

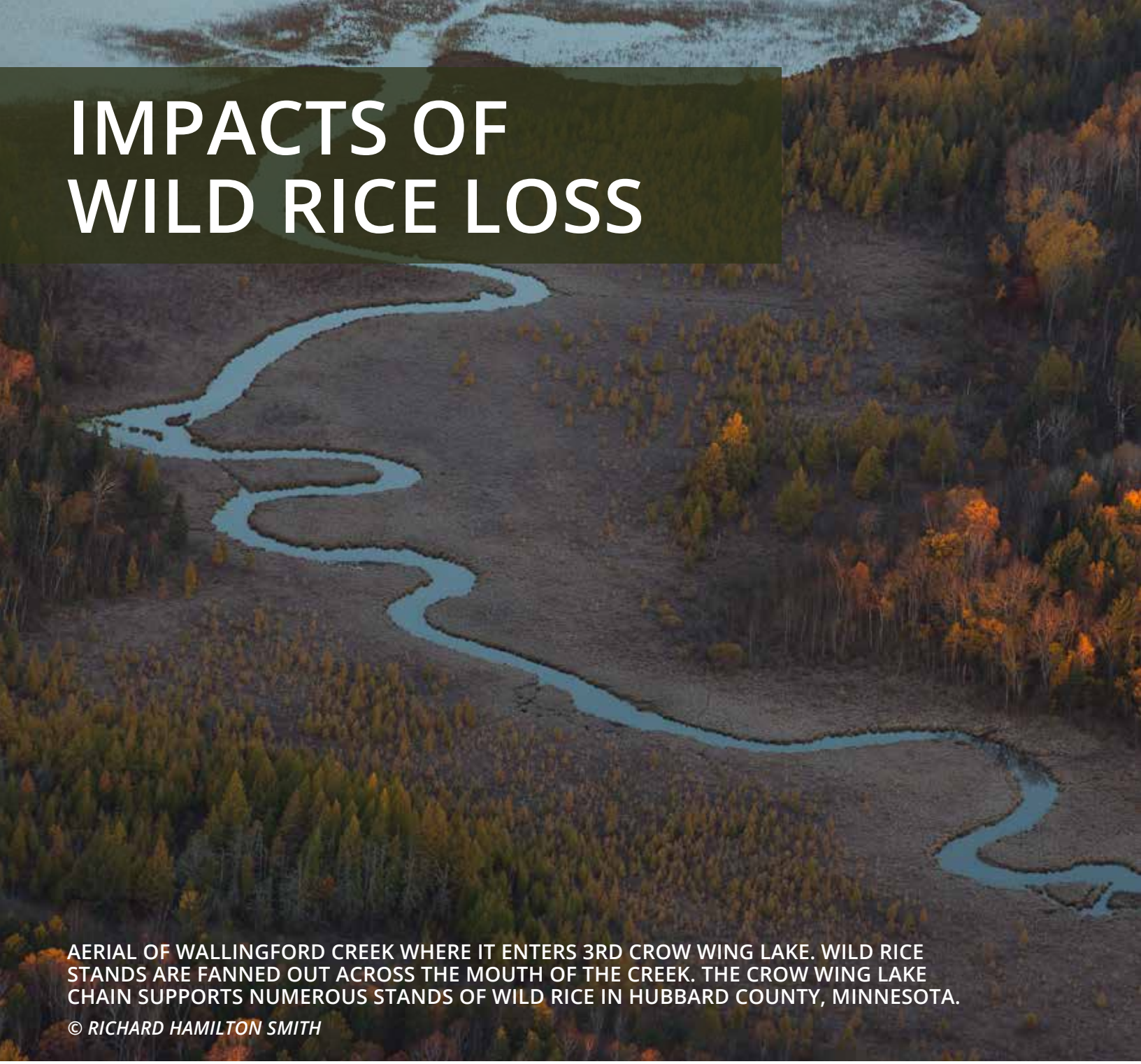
Table 8. License Sales Effects

IMPACT TYPE	EMPLOYMENT	LABOR INCOME	VALUE ADDED	OUTPUT
Direct Effect	0.1	$12,375	$14,329	$43,201
Indirect Effect	0.2	$12,087	$16,355	$30,667
Induced Effect	0.2	$7,762	$12,990	$22,706
Total Effect	**0.5**	**$32,224**	**$43,674**	**$96,574**

Table 9. Total Economic Contributions to the State Economy of Minnesota Associated with Hand-Harvested Wild Rice

IMPACT TYPE	EMPLOYMENT	LABOR INCOME	VALUE ADDED	OUTPUT
Direct Effect	116.9	$3,705,835	$4,631,752	$8,110,468
Indirect Effect	8.4	$532,438	$804,083	$1,499,982
Induced Effect	152.4	$7,313,718	$12,278,518	$21,418,720
Total Effect	**277.7**	**$11,551,991**	**$17,714,353**	**$31,029,171**

IMPACTS OF WILD RICE LOSS



AERIAL OF WALLINGFORD CREEK WHERE IT ENTERS 3RD CROW WING LAKE. WILD RICE STANDS ARE FANNED OUT ACROSS THE MOUTH OF THE CREEK. THE CROW WING LAKE CHAIN SUPPORTS NUMEROUS STANDS OF WILD RICE IN HUBBARD COUNTY, MINNESOTA.

SCENARIO ANALYSIS ALLOWS US TO BETTER UNDERSTAND THE POSSIBLE FUTURE OUTCOMES UNDER DIFFERENT CIRCUMSTANCES. WE CONDUCTED A ROBUST SCENARIO ANALYSIS TO ILLUSTRATE HOW CHANGES IN WILD RICE ABUNDANCE WILL AFFECT TWO THINGS: 1.) THE ALREADY SERIOUS LEVELS OF FOOD INSECURITY AMONG MINNESOTA TRIBES, AND 2.) THE ECONOMIC CONTRIBUTIONS OF WILD RICE HARVESTING TO THE STATE.

FOOD SECURITY-RELATED IMPACTS OF WILD RICE LOSS

Manoomin is an important resource in fighting the already severe levels of food insecurity among Native Americans. The loss of additional manoomin due to lower water quality standards will certainly increase food insecurity for those that depend on it as part of their diet. Research shows that food insecurity often results in higher health care costs for individuals, so it is likely that health care costs will increase, as well. This analysis estimates how every 1 percent decrease in manoomin consumption will affect replacement costs and health care costs.

A 1 percent decrease in annual, hand-harvested manoomin consumption among Native Americans in Minnesota amounts to between 1,545 and 5,631 fewer pounds per year, for an average of just over 3,500 pounds. Native Americans will have to replace this caloric loss with an equivalent substitute. If replaced with other hand-harvested manoomin at 11 dollars per pound, this would cost Native American consumers between 17,000 and 62,000 dollars — for an average of over 39,000 dollars. If replaced with store-bought, cultivated manoomin at 7.80 dollars per pound, Native Americans would face an additional 12,000 to 44,000 dollars per year in estimated replacement costs. These results are scalable, meaning that a two percent change would have double the effect of a one percent change.

With a one percent decrease in pounds consumed, the overall proportion of a person's diet that is composed of manoomin would decrease by as much as 3.5 percent. This decrease in manoomin consumption will result in an increase in food insecurity-related health care expenditures, as a smaller percentage of those costs will be avoided by the nutritional benefits of manoomin. Specifically, a one percent decrease in pounds consumed will result in an additional 368 to 4,908 dollars of food insecurity-related health care costs per year for Native Americans in Minnesota.

The robust health benefits of manoomin along with its importance in Ojibwe culture and as a traditional food make this resource essential to Native American food security in Minnesota. These results show that every 1 percent decrease in manoomin consumption can have great impacts on food security benefits in a population that is already vulnerable to food insecurity.

ECONOMIC IMPACTS OF DECREASED WILD RICE HARVEST

Given the impact that water quality can have on wild rice growth, understanding the economic significance in changes to wild rice abundance is crucially important to the management of wild rice areas. Presented here is a simple approach to estimating how a one percent decrease in wild rice harvest impacts proprietor income and the spending effects that stem from these contributions. Because these results are estimated using a linear input-output model, these results are scalable. This means that a two percent change in harvest has double the effect as a one percent change; a 50 percent change has 50 times the effect of a one percent change.

We previously estimated that tribal harvesters harvested approximately 9.6 million pounds of wild rice and sold 2.8 million pounds (of both green and processed rice). Applying a 1 percent decrease to the current estimated harvests means harvesters would gather about 100,000 fewer pounds of wild rice and sell about 27,000 fewer pounds. The one percent decrease in harvest results in a decrease in annual proprietor's income of 277,523 dollars. The change in harvest and proprietor income is estimated in Table 10. Using the IMPAN model once again, we then estimated the direct, induced, and indirect effects of this change (see Table 11). This loss of income results in about 2 jobs and almost 253,000 dollars in economic output being lost per one percent decrease in wild rice harvest.

Table 10. *Decrease in Proprietor Income Based on a Decrease in Harvest*

METRICS ESTIMATED	CURRENT HARVEST LEVELS	TOTAL HARVEST AFTER A 1% DECREASE	NET CHANGE
Total Harvesters	13,367	13,367	0
Harvesters who Sell	9,491	9,491	0
Pounds Sold - Unprocessed	399,234	395,241	-3,992
Pounds Sold - Processed	2,414,056	2,389,915	-24,141
Sale Price/lb. - Unprocessed	$3	$3	$0
Sale Price/lb. - Processed	$11	$11	$0
Revenue - Green	$1,197,702	$1,185,725	-$11,977
Revenue - Processed	$26,554,613	$26,289,067	-$265,546
Total Revenue	$27,752,315	$27,474,792	-$277,523
Less Expenses	$8,551,004	$8,551,004	$0
Proprietor's Income	$19,201,311	$18,923,788	-$277,523

ANNETTE DREWES PEELS THE CHAFF AWAY FROM A WILD RICE KERNEL.

© RICHARD HAMILTON SMITH

Table 11. Changes to Economic Contribution of Proprietor Income Due to Change in Wild Rice Harvest

IMPACT TYPE	EMPLOYMENT	LABOR INCOME	VALUE ADDED	OUTPUT
Proprietor's Income - Current Yields				
Direct Effect	0	$0	$0	$0
Indirect Effect	0	$0	$0	$0
Induced Effect	124.6	$5,974,687	$10,035,800	$17,500,478
Total Effect	**124.6**	**$5,974,687**	**$10,035,800**	**$17,500,478**
Proprietor's Income - 1 Percent Decrease in Harvest Yields				
Direct Effect	0	$0	$0	$0
Indirect Effect	0	$0	$0	$0
Induced Effect	122.8	$5,888,332	$9,890,749	$17,247,538
Total Effect	**122.8**	**$5,888,332**	**$9,890,749**	**$17,247,538**
Proprietor's Income - Net Change				
Direct Effect	0	$0	$0	$0
Indirect Effect	0	$0	$0	$0
Induced Effect	-1.8	-$86,355	-145,051	-$252,940
Total Effect	**-1.8**	**-$86,355**	**-145,051**	**-$252,940**

DISCUSSION

"IT IS A CULTURAL, HISTORICAL STAPLE, CENTRAL TO OUR SPIRITUALITY, CEREMONIES, AND TRADITIONAL LIFESTYLES."

FOND DU LAC BAND MEMBERS

Manoomin holds immeasurable value for the Ojibwe people, is an important component of lake ecology, and contributes 31 million dollars each year to Minnesota's economy. Yet in our economic development plans, conservation efforts, and legislative decisions, we often fail to account for the value that our natural resources provide. By taking nature into account, we can make better informed and more strategic decisions that lead to the proper safeguarding of this important asset and prosperity for those who depend on it.

Overall, this study finds that, alongside its cultural importance, manoomin is an important economic asset to the tribal communities that harvest it. Native Americans consume about 155,000 to 563,000 pounds of manoomin annually. Excluding the amount of manoomin that is already normally purchased rather than harvested, this has a direct replacement cost of approximately 1.3 to 4.7 million dollars at the market price of 11 dollars per pound. Tribal ricers also often sell a portion of their harvest, earning more than 19 million dollars each year in sales across the state, which amounts to an extra 2,000 dollars in income per harvester each year.

Direct economic activity related to wild rice harvesting contributes 117 jobs to the Minnesota economy. After considering secondary spending effects, wild rice currently contributes a total of about 278 jobs to Minnesota's economy. Though these estimates may not seem overwhelmingly significant, one way that economists can compare industries is by comparing jobs supported per million dollars in investment. Our analysis shows that for each 1 million dollars in spending associated with wild rice, about a dozen jobs are supported. Comparing this to other industries in Minnesota, such as the auto manufacturing industry (fewer than 3 jobs per million dollars invested), or the construction industry (13 jobs per million dollars invested) shows that hand-harvested wild rice is not an insignificant economic driver in the state. The harvest of wild rice has already declined significantly in recent decades; further declines in wild rice would lead to further economic cost for Minnesota.

Most importantly, a decline in manoomin abundance has serious implications for Minnesotan tribes. In light of the already serious levels of food insecurity they experience, this raises important issues of food justice. Every 1 percent decrease in annual consumption of manoomin by Native Americans means the loss of about 3,500 pounds of healthy, traditional foods in the Ojibwe diet. Traditional foods such as manoomin help to reduce food insecurity and can also ease diet-related health issues. It is likely that a decrease in manoomin would increase health care costs related to food insecurity issues for an already vulnerable population. Already, manoomin (or psin in the Dakota language) has disappeared from Dakota community lands in southern Minnesota. There is no appropriate substitute for manoomin in either Native American diet or culture in Minnesota. The Dakota tribes have lost an important cultural and subsistence resource, along with the cultural and nutritional benefits that it provided past generations.

While this report looked at the economic benefits of wild rice harvesting, there are further economic benefits we were unable to define. Wild rice supports other economic sectors such as waterfowl hunting – a 43 million dollar industry in Minnesota. Restoration of wild rice is a significant effort in the state, which also has economic activity associated with it. Conservation agencies, tribes, and other groups and organizations invest enormous amounts of money in ecosystem restoration projects that

WE REITERATE HERE THAT THERE IS NO ECONOMIC FRAMEWORK THAT CAN PROPERLY DEFINE THE VALUE OF MANOOMIN TO THE OJIBWE PEOPLE.

The economic values in this report should be regarded as just a small portion of the true value of manoomin. The values in this report don't include the value people place on participating in hand-harvesting of manoomin, or the importance of manoomin in Ojibwe tradition and history, or the many other important cultural values manoomin holds. "It is a cultural, historical staple, central to our spirituality, ceremonies, and traditional lifestyles," Fond du Lac band members say. "Manoomin is medicine, a way of life, traditional, and [a] very important food source."

rely on native wild rice. These expenditures all have effects that ripple across sectors throughout the region and support local jobs.

Furthermore, this analysis does not estimate the trade of manoomin that occurs within the tribal economy. The tribal gift and barter economy supports lifestyles well beyond what is shown here and should not be discounted. An in-depth analysis would need to be conducted to even partially understand the intricacy and importance of this commodity to Native American communities in Minnesota.

Wild rice provides much more than just economic benefits to non-tribal people who gather and consume it as well. Enjoying the sights, sounds, and experiences of being outdoors and on the water are part of Minnesota life. One non-tribal ricer said, "We enjoy being outdoors, on the water, listening and watching birds and other wildlife, and being in places where motorized boats generally can't go… we look forward to harvesting each year as a fun activity that we can do together, as a way to gather a component of our diet, as a way to obtain a present for family and friends. It's incredibly satisfying gathering your own food."

Minnesota's wild rice is an asset worthy of investment and protection. The values presented in this report reveal the breadth and magnitude of the economic benefits that wild rice provides to Minnesota. Despite constraints due to data gaps and the granularity and precision of the analysis, the results presented here provide a broad sense of the economic importance of this asset. However, increased understanding of the economic benefits of wild rice and economic contributions to communities can help to build shared goals and sustainable management decisions. By making the economic case for the protection of wild rice habitat, we aim to ensure that both the economic and non-economic benefits of this treasured resource will be enjoyed for generations to come.

ANNETTE DREWES AND KRISTI OLSON HARVESTING WILD RICE ON A NORTHERN MINNESOTA LAKE NEAR BEMIDJI, MINNESOTA

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APPENDIX

WILD RICE RESTORATION RESEEDING THE ST LOUIS RIVER ESTUARY
CREDIT: CHERYL KATZ

"IT'S IN OUR STORIES – IT BROUGHT US HERE – IT'S THE LIFE OF US."
FOND DU LAC BAND MEMBERS

A: DETAILED CALCULATIONS FOR FOOD SECURITY

This appendix provides the calculations for overall consumption of manoomin by Native Americans in Minnesota as well as the replacement and health care costs.

Table 12. Calculations Performed to Estimate Consumption of Manoomin

FREQUENCY OF WILD RICE CONSUMPTION*	**PERCENTAGE OF SURVEY RESPONDENTS****	**EXTRAPOLATED TO NATIVE AMERICAN POPULATION IN MINNESOTA**	**TIMES EATEN PER YEAR** (MIN-MAX)	TOTAL SERVINGS AT **1 SERVING PER OCCURRENCE** (MIN-MAX)	TOTAL SERVINGS AT **2 SERVINGS PER OCCURRENCE** (MIN-MAX)
Never	5%	2,683	0	0	0
<= 1 time/month	62%	37,829	1 - 12	37,829 - 453,946	75,658- 907,892
1-3 times/month	18%	11,148	12 - 36	133,772 - 401,315	267,543 - 802,629
3 times/ month-weekly	2%	1,218	36 - 52	43,860 - 63,353	87,719 - 126,705
1-2 times/week	8%	4,812	52 - 104	250,243 - 500,486	500,486 - 1,000,972
>2 times/week	5%	2,985	>105	> 313,413	> 626,826
TOTAL SERVINGS				**779,116 - 1,419,099**	**1,558,231 - 2,838,198**

**Source: 2014 Fond du Lac Community Bio-monitoring Survey*
***Based on total population of 60,916*

Table13. Manoomin Consumption by Native Americans in Minnesota Per Year

	TOTAL/YEAR (MINIMUM)	**TOTAL/YEAR** (MAXIMUM)	**AVERAGE**
Servings	779,116	2,838,198	1,808,657
Grams*	70,120,408	255,437,844	162,779,126
Pounds	154,586	563,135	358,860
Pounds per Person	2.67	9.73	6.2
Proportion of Diet**	0.13%	0.49%	0.31%

**One serving of uncooked wild rice is 90 grams*
***Based on an average annual diet of 1,996 pounds*

Table 14. Replacement Costs of Manoomin for Native Americans in Minnesota

	MINIMUM	MAXIMUM	AVERAGE
Consumption			
Pounds of Wild Rice Consumed	154,586	563,135	358,861
Pounds of Hand-Harvested Wild Rice Consumed*	117,028	426,317	271,673
Replacement Costs			
Cost of Hand-Harvested Wild Rice**	$1,287,308	$4,689,487	$2,988,398
1 Percent Decrease in Consumption			
Decrease in Total Pounds of Wild Rice Consumed	1,546	5,613	3,579
Replacement Cost of Decreased Pounds	$17,006	$61,743	$39,375

**Based on survey data that 76% of Native American consumers eat hand-harvested wild rice*
***At $11.00/pound*

Table 15. Food Insecurity-Related Health Care Costs for Native Americans in Minnesota

	MINIMUM	MAXIMUM	AVERAGE
Percent of Diet			
Percent of Diet Composed of Wild Rice	0.133%	0.49%	0.31%
Health Care Costs of Food Insecurity for Native Americans in Minnesota			
Food Insecurity-Related Health Care Costs*			$28,371,627
Avoided Health Care Costs			
Food Insecurity-Related Costs Prevented by Wild Rice**	$37,961	$141,858	$89,910
1 Percent Decrease in Consumption			
New Proportion of Diet	0.132%	0.48%	0.30%
New Food Insecurity Costs Prevented by Wild Rice	$37,592	$136,950	$87,271
Addt'l Unavoided Health Care Costs with 1 Percent Decrease	$369	$4,908	$2,638

**Based on the estimate that 25% of Native Americans in Minnesota (15,229 people) are food insecure with $1,863 in related health care costs*
***The proportion of diet prevents a corresponding amount of the food insecurity health costs*

WILD RICE BLOOMS IN FRONT OF A CANOEIST ON THE MISSISSIPPI RIVER A FEW MILES DOWNSTREAM OF ITS SOURCE IN ITASCA STATE PARK, MINNESOTA.

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B: SUMMARY STATISTICS FROM **HARVESTER SURVEY**

This appendix provides results and statistics for the data received from the survey implemented jointly by Earth Economics and the Fond du Lac Band of Lake Superior Chippewa.

***Table 16**. Summary Statistics for Non-Tribal Ricers*

METRIC	MEAN	MEDIAN	STANDARD DEVIATION	95% CONFIDENCE INTERVAL	MINIMUM	MAXIMUM	SAMPLE SIZE
Annual Harvest	106.8	50	118.57	±77.47	7	525	9
Proportion Sold	n/a	n/a	n/a	n/a	n/a	n/a	0
Proportion Kept	0.75	0.8	0.25	±0.17	0.2	1	9
Proportion Gifted	0.25	0.2	0.25	±0.17	0	0.8	9
Sale ($/lb)	n/a	n/a	n/a	n/a	0	n/a	0
Expenditures							
Clothing	$21.25	$10	$32.38	±$22.44	$0	$100	8
Distribution	$2.19	$0	$5.96	±$4.13	$0	$20	8
Equipment	$14.77	$3.83	$25.53	±$17.69	$0	$100	8
Gas	$63.89	$50	$55.99	±$36.58	$10	$200	9
Professional Services	$31.44	$25	$28.94	±$18.90	$0	$100	9
Other	$81.63	$23	$131.32	±$91	$0	$400	8

Table 17. Summary Statistics for Tribal Ricers

METRIC	MEAN	MEDIAN	STANDARD DEVIATION	95% CONFIDENCE INTERVAL	MINIMUM	MAXIMUM	SAMPLE SIZE
Annual Harvest	973	600	866.82	±537.25	80	3,000	10
Proportion Sold	0.21	0.05	0.31	±0.19	0	0.97	10
Proportion Kept	0.32	0.45	0.24	±0.16	0.01	0.6	8
Proportion Gifted	0.26	0.29	0.19	±0.13	0.01	0.5	8
Sale ($/lb)	11	10	2.08	±1.82	9	15	5
Expenditures							
Clothing	$39	$5	$63.14	±$39.14	$0	$200	10
Distribution	$197	$0	$532.06	±$329.77	$0	$2,000	10
Equipment	$67.50	$0	$149.16	±$92.45	$0	$500	10
Gas	$257.50	$150	$287.51	±$178.20	$40	$1,000	10
Professional Services	$25.50	$0	$39.42	±$24.43	$0	$100	10
Other	$315.28	$0	$695.99	±$454.71	$0	$2,500	9

TRUMPETER SWANS FEED ON GOLDEN STANDS OF WILD RICE IN THE FALL ON INDIAN CREEK, NEAR TWO INLETS IN MINNESOTA. INDIAN CREEK IMPOUNDMENT IS A LEGACY FUNDED SITE FOR WATERFOWL RESTORATION.

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